Determine the limiting reagent in the combustion of benzene when 24 grams of benzene is mixed with 62.5 liters of O_2. Please first balance the chemical equation.

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Solution: Step 1. Balance the chemical equation

$$C_6H_6(\ell) + 15/2\ O_2(g) \rightarrow 6\ CO_2(g) + 3\ H_2O\ (\ell)$$

Step 2. calculate the number of moles of C_6H_6 and O_2 in the reaction

$$n_{C_6H_6} = \frac{m_{C_6H_6}}{M_m} = \frac{24\ gm}{78\ gm/mol} = 0.307\ mol$$

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$$n_{O_2} = \frac{PV}{RT} = \frac{(1\ atm)(62.5\ L)}{\left(0.08206\ \frac{Latm}{molK}\right)(298\ K)} = 2.555\ mol$$

To see which is the limiting reagent we must compare the actual mole ratio to the stoichiometry.

Determine the limiting reagent in the combustion of benzene when 24 grams of benzene is mixed with 62.4 liters of O_2.

$$C_6H_6(\ell) + 15/2\ O_2(g) \rightarrow 6\ CO_2(g) + 3\ H_2O\ (\ell)$$

The actual mole ratio is

$$\frac{n_{O_2}}{n_{C_6H_6}} = \frac{2.555\ mol}{0.307\ mol} = 8.32$$

The stoichiometric ratio is 7.5. Therefore, then is an excess of O_2 and the C_6H_6 is the limiting reagent.